

What is claimed is:

1. A method of single-user projection detection in a multiple-access communication system, comprising the steps of:

- i) defining a frame including a plurality of user signals, each user signal having at least three symbols within a window of the frame;
- ii) approximating a plurality of symbol amplitudes for each user among a plurality of users in the window;
- iii) computing a set of correlation matrices based upon a plurality of channel parameters in the frame;
- iv) calculating a current estimate of the approximated symbol amplitudes corresponding to at least one symbol of every user in the window using the set of correlation matrices in a perturbation correction technique; and
- v) shifting the window of the frame and returning to step (iv) when an entire user signal has not been processed.

2. The method according to claim 1, wherein the symbol amplitude approximation is the current estimate of the symbol amplitude, the method further comprising the step of:

- vi) detecting the signals of a single-user when the symbol amplitudes for the particular user over the frame have been estimated.

3. The method according to claim 1, further comprising the step of:

- (vii) returning to step (iv) to perform higher order perturbation processing; and
- (viii) returning to step (ii) upon defining a new frame.

4. The method according to claim 1, wherein the perturbation correction value in step (iv) is obtained from a set of linear equations for calculating a plurality of perturbation amplitudes within the window based on a plurality of previously estimated amplitudes of each user and the correlation matrix in the window.

5. A method of multi-user decorrelation detection in a multiple-access communication system, comprising the steps of:

- i) defining a frame including a plurality of user signals, each user signal having at least three symbols within the frame;
- ii) approximating a plurality of symbol amplitudes for each user among a plurality of users in the frame;
- iii) computing a decorrelation matrix and a set of correlation matrices based upon a plurality of channel parameters in the frame;
- iv) calculating a current estimate of the approximated symbol amplitudes corresponding to at least one symbol of every user in the window using the decorrelation matrix and a set of correlation matrices in a perturbation correction calculation; and
- v) shifting the window and returning to step (iv) when an entire user signal has not

been processed.

6. The method according to claim 5, wherein the symbol amplitude approximation is the current estimate of the symbol amplitude, the method further comprising:

- vi) detecting the signals of a single-user when the symbol amplitudes for the particular user over the frame have been estimated.

7. The method according to claim 5, further comprising the step of:

- (vii) returning to step (iv) to perform higher order perturbation processing; and
- (viii) returning to step (ii) upon defining a new frame.

8. The method according to claim 5, wherein the perturbation correction value in step (iv) is obtained from a set of linear equations for calculating a plurality of perturbation amplitudes within the window based on a plurality of previously estimated amplitudes of each user and the correlation matrix in the window.

9. A method of detecting at least one of a plurality of users in a multiple-access communication system, comprising the steps of:

- i) defining a frame including a plurality of user signals, each signal being allocated at least three symbols within a window of the frame;
- ii) comparing a delay spread of the frame to a predetermined threshold;
- iii) approximating a symbol amplitude for each user of the plurality of users in the window;
- iv) computing a set of correlation matrices and a decorrelation matrix based upon a plurality of channel parameters in the frame, the set of correlation matrices and decorrelation matrix being determined by a result of the delay spread comparison;
- v) calculating a current estimate of the approximated symbol amplitude corresponding to at least one symbol of each user in the window using the determined matrices in a perturbation correction calculation; and
- vi) shifting the window and returning to step (v) when an entire user signal has not

been processed.

10. The method according to claim 9, wherein the symbol amplitude approximation is the current estimate of the symbol amplitude, the method further comprising the step of:

vii) detecting the signals of at least one of a plurality of users when the symbol amplitude for the particular user over the frame has been estimated.

11. The method according to claim 9, comprising the step of:

(vii) returning to step (iv) to perform higher order perturbation value processing; and
(viii) returning to step (ii) when a new frame is defined.

12. The method according to claim 9, wherein the perturbation correction in step (iv) is obtained from the set of linear equations for calculating a plurality of perturbation amplitudes within the window based on previously estimated amplitudes of each user and the correlation matrix in the window.

13. The method according to claim 9, wherein step (iv) includes the substep of computing a correlation matrix and decorrelation matrix when the delay spread is below the predetermined threshold.

14. The method according to claim 9, wherein step (iv) includes the substep of computing a correlation matrix when the delay spread is above the predetermined threshold.

15. A method of detection in a multiple-access communication system, comprising the steps of:

i) defining a frame including a plurality of user signals, each user signal having at least three symbols within a window of the frame;

ii) approximating a symbol amplitude for each user of the plurality of users in the frame;

iii) obtaining a perturbation correction value using immediate feedback, wherein a new estimated amplitude is used as soon as it is available;

iv) calculating a current estimate of the approximated symbol amplitude corresponding to at least one symbol of every user in the frame based upon a perturbation correction calculation; and

v) shifting the window and returning to step (iv) when an entire user signal has not been processed.

16. The method according to claim 15, wherein the symbol amplitude approximation is the current estimate of the symbol amplitude, the method further comprising the step of:

vi) detecting the signals of a single-user when the symbol amplitudes for the particular user over the frame have been estimated.

17. The method according to claim 15, further comprising the step of:

(vii) returning to step (iv) to perform higher order perturbation processing; and

(viii) returning to step (ii) upon defining a new frame.

18. The method according to any one of claims 1, 5, 9, or 15, wherein the symbols within the frame are defined by a group of channel parameters, step (i) of each claim further comprising the substeps of:

defining a set of margins for each parameter of each user within a channel; and

determining a duration of the frame based upon the set of margins.

19. The method according to claim 15, wherein the perturbation correction in step (iv) is obtained from a set of linear equations for a plurality of perturbation amplitudes within the window based on a plurality of previously estimated amplitudes of each user and the correlation matrix in the window.

20. An apparatus for detecting at least one of a plurality of users in a multiple-access communication system comprising:

means for defining a frame, wherein the frame includes a plurality of user signals each user signal having at least three symbols within a window of the frame;

means for approximating a plurality of symbol amplitudes for each user among a plurality of users in the window;

means for computing a set of correlation matrices based upon a plurality of channel parameters in the frame;

means for calculating a current estimate of the approximated symbol amplitudes corresponding to at least one symbol for every user in the window using the set of correlation matrices and the decorrelation matrix in a perturbation correction technique;

means for shifting the window of the frame and recalculating the current estimate of the symbol amplitude when an entire user signal has not been processed; and

means for detecting the signal of at least one of a plurality of users when the symbol amplitude for the at least one user has been estimated.